Hemodynamic Phenotype Guide

10 phenotypes across 4 clusters for rapid hemodynamic classification in hypotensive patients

Cluster 1 — Small / Normal Cavity with Hyperdynamic Function

P1 Hypovolemic Shock

Key Findings	Small LV & RV cavities | Hyperdynamic contraction | Flat, collapsing IVC (>50%) | A-lines bilaterally (dry lungs)
Consider	Hemorrhage (trauma, GI bleed, surgical) | Severe dehydration | Third-spacing | Burns
Clinical Tip	*Kissing papillary muscles on 4-chamber view is a classic sign of severe hypovolemia.*

P2 Distributive Shock

Key Findings	Normal/adequate LV & RV cavities | Hyperdynamic contraction | Normal or dilated IVC | A-lines (dry lungs)
Consider	Sepsis (most common) | Anaphylaxis | Neurogenic shock | Adrenal crisis | Drug-induced vasodilation
Clinical Tip	*Differentiates from P1 by IVC status — distributive has adequate preload but low SVR.*

P3 Diastolic Dysfunction

Key Findings	Thick-walled LV (concentric hypertrophy) | Small cavity appearance | May overlap with P1 or P2 pattern
Consider	Chronic hypertension | HFpEF | Hypertrophic cardiomyopathy | Aortic stenosis
Clinical Tip	*LV wall thickness >12 mm suggests chronic remodeling; these patients need higher filling pressures.*

Cluster 2 — Dilated LV with Decreased Contractility

P4 LV Cardiogenic Shock

Key Findings	Dilated LV | Severely reduced LV squeeze | Plethoric (non-collapsing) IVC | B-lines bilaterally (pulmonary edema)
Consider	Acute myocardial infarction | Decompensated cardiomyopathy | Myocarditis | Takotsubo | Post-cardiotomy
Clinical Tip	*Avoid aggressive fluid resuscitation. Consider inotropes and vasopressors.*

P5 Biventricular Failure

Key Findings	Both LV and RV dilated | Globally reduced function | Plethoric IVC | Bilateral B-lines | May see pleural effusions
Consider	End-stage cardiomyopathy | Severe septic cardiomyopathy | Advanced valvular disease
Clinical Tip	*Worst prognosis phenotype. May need mechanical circulatory support.*

Cluster 3 — Isolated Dilated RV

P6 Acute RV Failure

Key Findings	RV > LV (RV:LV ratio > 1) | Interventricular septal shift toward LV | Thin RV wall (<5 mm) | Plethoric IVC | McConnell's sign possible
Consider	Massive pulmonary embolism | Acute ARDS | Acute RV infarction | Air embolism
Clinical Tip	*Acute PE is a time-critical diagnosis — look for RV free-wall hypokinesis with apical sparing (McConnell's sign).*

P7 Acute-on-Chronic RV Failure

Key Findings	RV dilation with thickened wall (>5 mm) | RA enlargement | Septal flattening (D-shape) | Plethoric IVC | Tricuspid regurgitation
Consider	Pulmonary hypertension | Chronic thromboembolic disease | COPD / Cor pulmonale | Congenital heart disease
Clinical Tip	*Thick RV wall indicates chronicity; acute decompensation often triggered by infection, PE, or volume overload.*

Cluster 4 — Obstructive / Mechanical Causes

P8 Pericardial Tamponade

Key Findings	Pericardial effusion (>10 mm) | RA diastolic collapse | RV diastolic collapse | Plethoric IVC | Swinging heart
Consider	Malignancy | Uremia | Post-procedural (cath lab, pacemaker) | Aortic dissection | Trauma | Post-MI (Dressler's)
Clinical Tip	*Even small effusions can cause tamponade if rapid accumulation. Absence of collapse does not exclude tamponade in RV hypertrophy.*

P9 Catastrophic Valve Disease

Key Findings	Visible valve abnormality (flail leaflet, vegetation) | Chamber dilation | Plethoric IVC | B-lines (acute MR/AR)
Consider	Acute mitral regurgitation (chordal rupture) | Acute aortic regurgitation | Endocarditis with valve destruction
Clinical Tip	*May be subtle on subcostal views — large, mobile echogenic mass or erratic leaflet motion.*

P10 Tension Pneumothorax / Auto-PEEP

Key Findings	Small, hyperdynamic heart | Plethoric IVC | Absent lung sliding on affected side | Barcode (stratosphere) sign on M-mode | No B-lines
Consider	Tension pneumothorax | Auto-PEEP / breath stacking | Dynamic hyperinflation in severe asthma / COPD
Clinical Tip	*The combination of plethoric IVC + small hyperdynamic heart + absent lung sliding is virtually pathognomonic.*

Reference: Bughrara et al. *CCM* 2024; Howell-Clark et al. *JoVE* 2025 | easypocus.net